CGJSC / RCESSC
Vol. 1, Iss/Num. 1, Summer/Été 2012

CANADIAN GRADUATE JOURNAL OF SOCIOLOGY AND CRIMINOLOGY

The Prevalence of Alcohol-Impaired Driving in Edmonton, Alberta: 1991 – 2009

Abu Sadat Nurullah
University of Alberta, Department of Sociology

This study explores the changes in alcohol-impaired driving among a representative sample of Edmontonians from 1991 to 2009. Based on self-report data from the annual Alberta Surveys of 1991, 1992, 1997, and 2009, this study also traces the shift in the impact of standard demographic factors on alcohol-impaired driving in Edmonton, Alberta. Findings show that self-reported alcohol-impaired driving has decreased substantially over the years (10.6% in 1991, 8.4% in 1992, 7.2% in 1997, and 3.7% in 2009). However, there have been little changes in designated driving. In addition, there have been a shift in age-related impaired driving, i.e., people aged 55-65+ report impaired driving more in 2009 (4.8%) compared to 1991 (2.0%) and 1992 (2.2%); while individuals aged 18-34 and 35-54 report impaired driving less in 2009 (4.8% and 2.6%, respectively) compared to 1991 (12.7% and 13.0%, respectively). Logistic regression analyses indicate that gender is a significant predictor of alcohol-impaired driving in 1991 (OR = 3.29, 95% CI = 1.52–7.16), but not in 2009. However, the interaction between age and gender is not significant. The policy implications of the findings are discussed.

Keywords: Alcohol-impaired driving; designated driving; gender; Alberta

Cette étude porte sur les changements dans la conduite affaiblie par l'alcool chez un échantillon représentatif de résidents d'Edmonton entre 1991 et 2009. Fondée sur des déclarations fournies par les automobilistes à l'occasion d'enquêtes annuelles menées en Alberta en 1991, 1992, 1997 et 2009, l'étude décrit aussi des fluctuations dans la portée de facteurs démographiques standard sur la conduite avec facultés affaiblies par l'alcool à Edmonton (Alberta). Les conclusions démontrent une diminution considérable des déclarations de conduite avec facultés affaiblies par l'alcool sur plusieurs années (10,6% en 1991, 8,4% en 1992, 7,2% en 1997, et 3,7% en 2009). Néanmoins, peu de changements ont été observés dans le recours aux conducteurs désignés. En outre, la fréquence de la conduite avec facultés affaiblies a connu des variations dans les différents groupes d'âge. Par exemple, les personnes âgées de 55 ans et plus ont plus souvent déclaré avoir conduit avec des facultés affaiblies en 2009 (4,8%) qu'en 1991 (2,0%) et en 1992 (2,2%), tandis que les personnes âgées de 18 à 34 ans et de 35 à 54 ans ont déclaré moins souvent avoir conduit avec les facultés affaiblies en 2009 (4,8% et 2,6%, respectivement) qu'en 1991 (12,7% et 13,0%, respectivement). Des analyses de régression logistique indiquent que le sexe a été une importante variable explicative de la conduits avec facultés affaiblies en 1991 (OR = 3,29, 95% CI = 1,52–7.16), ce qui n'a pas été le cas en 2009. Malgré cela, l'interaction entre l'âge et le sexe n'est pas significative. L'étude comprend une analyse des répercussions de ses conclusions sur certaines politiques.

Mots-clés: conduite avec facultés affaiblies; conducteur désigné; sexe; Alberta

Introduction

Although there has been a marginal decline in criminal charges related to alcohol-impaired driving during the past few years, it continues to be a key factor leading to preventable traffic injuries and death in Canada. This is evident in three nationally representative surveys on alcohol consumption among Canadians (National Alcohol and Drug Survey conducted in 1989, Canada's Alcohol and other Drugs Survey conducted in 1994, and the Canadian Addiction Survey conducted in 2004). The 2004 Canadian

Addiction Survey indicates the prevalence of alcohol-related impaired driving in Alberta. According to the survey, 9.1 percent of Albertans (approximately 214,000 Albertans) report that they have driven a vehicle after consuming two or more alcoholic drinks in the previous hour, and twice as many (18.2 percent; approximately 427,000 Albertans) report that they have been a passenger in a vehicle driven by a person who have consumed two or more alcoholic drinks in the previous hour during the past year (Alberta Alcohol and Drug Abuse Commission, 2006).

Compared with other provinces and territories in Canada, in 2006, Alberta had the fifth highest fatality rate at 13.4 per 100,000 population, and the highest injury rate at 769.1 per 100,000 population (Danyluk & Holmes, 2008). In addition, Alberta had the highest rate of fatally-injured drivers with a blood alcohol concentration (BAC) above .08 percent (3.44 per 100,000 licensed drivers, compared to a national rate of 1.84) in Canada (Solomon & Chamberlain, 2010). Moreover, each year about 400 people die and more than 26,000 people are injured in over 122,000 motor vehicle collisions in Alberta due to legally impaired (i.e., BAC over 80 mg%) driving (Danyluk & Holmes, 2008).

Over the last two decades, stricter penalties (e.g., a zero alcohol tolerance policy for novice drivers, blood alcohol concentration [BAC] of 0.08/0.05 percent, increased price of alcohol, etc.) have been enforced. Although the rate of impaired driving offences has declined over the last 25 years (see: Brennan & Dauvergne, 2011), it remains an important contributor to traffic fatalities in Alberta. Therefore, research is needed that addresses the prevalence of impaired driving in this area of Canada. In one study, Nurullah (2010a) finds that four percent of adult Albertans (aged 18 and above) report driving a vehicle while impaired (over the legal BAC limit) within the past 12 months. Similarly, Vanlaar, Marcoux, and Robertson (2009) find that 5.6 percent of Canadians report driving at least once within the past 12 months with blood alcohol concentrations (BAC) over 0.08%. Have there been any changes in self-reported alcohol-impaired driving incidents in Edmonton, Alberta since 1991? Have there been any changes in self-reported incidents of being passengers in a vehicle driven by an impaired driver? The current study aims to explore these questions using a representative sample of Edmontonians.

Existing Literature on Alcohol-impaired Driving

Effects of Alcohol Consumption on Impaired Driving

Alcohol-impaired driving is one of the major social problems in Canada, resulting in severe injuries and deaths that are preventable (Beirness & Davis, 2007; Nurullah 2010b). In 1982, 60 percent of drivers killed in road crashes in Canada tested positive for alcohol (Beirness, Simpson, Mayhew, & Wilson, 1994). In a 1983 survey conducted by Transport Canada, 51.8 percent of respondents report operating a vehicle within two hours of consuming alcohol within the past 30 days (Wilson, 1984). A subsequent study in 1988 finds 24.6 percent of drinkers report driving within an hour of consuming two or more alcoholic drinks within the past 12 months (Simpson, Mayhew, & Beirness, 1992). A 1994 study reports 20.5 percent of respondents have operated vehicles after drinking within the past 12 months (McNeil & Webster, 1997). The 2004 Canadian Addiction Survey finds 11.6 percent of licensed drivers have operated a vehicle within an hour of having consumed two or more alcoholic drinks (Beirness & Davis, 2007).

In a time-series analysis for the period of 1972 to 1990 in Ontario, Adrian, Ferguson, and Her (2001) find a strong positive correlation between alcohol consumption and both alcohol involved traffic offenses ($r = .89$, $p < .01$) and alcohol involved traffic accidents ($r = .82$, $p < .01$). Two factors that have contributed strongly to motor vehicle injuries and fatalities in Alberta and Canada are alcohol-impaired driving and failure to use seat belts (Desapriya, Pike, & Babul, 2006). According to a Transport Canada (2008) report, during the years 2003-2005, 83 percent of fatally injured drinking drivers had been legally impaired, i.e., had a BAC over 80 mg%. Studies consistently provide ample evidence indicating alcohol use as a contributing causal factor for injury (Rehm et al., 2003). This claim is supported by studies that compare injured cases to non-injured controls (e.g., Borges, Cherpitel, Orozco, Bond, Ye, & Macdonald, 2006), and experimental studies (e.g., Eckardt et al., 1998).

Passengers of Drinking Drivers

Dellinger, Bolen, and Sacks (1999) use passenger estimates of drinking and driving to suggest that this behavior may be under-reported by drivers, who may have different perceptions of what constitutes impairment while driving. They find that individuals who report drinking and driving are also more likely to report riding with a drinking driver (44 percent versus 4 percent for persons who do not report drinking and driving). In a study of the blood alcohol concentration (BAC) of passengers, Foss and Bierness (1996) find that among legally impaired drivers with a passenger, 53 percent of passengers have a BAC level of 0.08% and above. These two studies suggest that the rate of impaired driving may be underestimated, and that passengers of drinking drivers are half the time impaired themselves. In addition, Leadbeater, Foran, and Grove-White (2008) find that riding with a peer who have been drinking is strongly associated with adolescents' alcohol-impaired driving, after accounting for all other variables in the equation ($\beta = .42$).

Studies also find regional differences in riding with a legally impaired driver. For instance, 31.9 percent of Ontario high school students report riding in a vehicle with a driver who has consumed alcohol (Adlaf, Mann, & Paglia, 2003). A study in Atlantic Canada finds that overall, 23.3 percent of youth report riding with a driver who has had too much to drink (Poulin, Boudreau, & Ashbridge, 2006). A British Columbia study finds that 13 percent of all residents report that they have ridden within the last 12 months with a cannabis-intoxicated driver, and this is more common among younger compared to older respondents (Stockwell, Sturge, & Jones, 2006). However, the reasons for these regional differences and the factors that contribute to those differences are unclear.

Socio-demographic Factors and Impaired Driving

Existing literature has consistently shown that males are considerably more likely to drive while impaired compared to females. These findings have been confirmed both in the general population (Adebayo, 1991; Beirness & Davis, 2007; Holmila & Raitasalo, 2005; Schwartz, 2008) and in college student sample (Marelich, Berger, & McKenna, 2000; Wechsler, Lee, Nelson, & Lee, 2003). In a sample of 324 urban residents in Edmonton, Adebayo (1991) finds that more males have driven a vehicle while impaired (44 percent) compared to females (23 percent).

Previous studies constantly report that drinking and driving behavior is more prevalent among youth compared to members of older populations (Hingson, Zha, & Weitzman, 2009; Leadbeater, Foran, & Grove-White, 2008; McCartt, Mayhew, Braitman, Ferguson, & Simpson, 2009; Poulin, Boudreau, & Ashbridge, 2006). In addition, research indicates that young people are more likely to ride with an impaired driver in comparison to older people (Dellinger, Bolen, & Sacks, 1999). Adebayo (1991) reports that older respondents are less likely than younger ones to drive a vehicle while impaired. Belton, Jhangri, MacDonald, and Voaklander (2005) find in a sample of rural Alberta drivers that alcohol impairment is more prevalent among the drivers aged between 16 and 24. Peck et al. (2008) suggest that crash averting skills of young drivers are more adversely affected by alcohol due to their driving inexperience, immaturity, and less experience with alcohol.

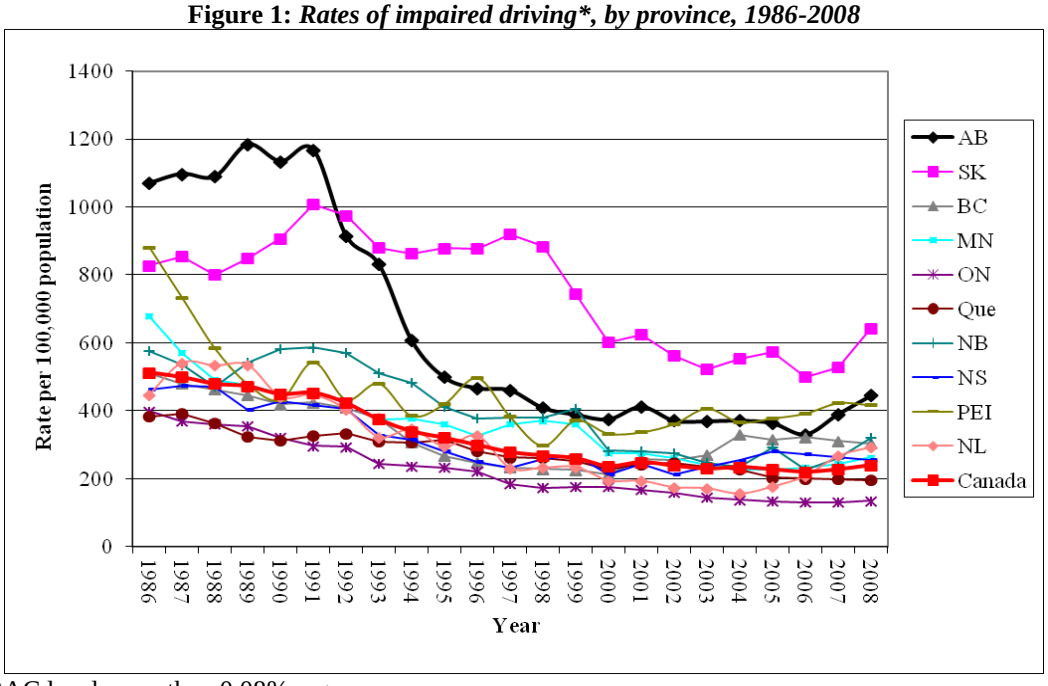
Studies show the impact of other socio-demographic factors — such as level of education, income, employment status, and marital status — on impaired driving. Belton et al. (2005) find in a sample of rural Alberta drivers that single individuals and those with high-school education or less are more likely to be legally impaired. Caetano and McGrath (2005) find that driving under the influence of alcohol and drugs is higher among those with college degree and above, those with high income, among young, males, non-married, white, and employed (full-time). Hasin, Paykin, Endicott, and Grant (1999) find that impaired driving is more prevalent among males, younger population, those with more years of education, white, unmarried, and among the employed. Adebayo (1991) finds significantly more single respondents (57 percent) report driving while impaired than married respondents (27 percent). Adebayo

(1991) also finds that those who are employed full-time are more likely to drive while impaired, compared to those who are unemployed.

Based on the 2004 Canadian Addiction Survey, Beirness and Davis (2007) report that drinking drivers are less likely to be married, but more likely to have a full-time job and to have significantly higher average annual income. Drixler, Krahn, and Wood (2001) find that rural youth with more disposable income, more educational ambition, more church attendance, and more respect for authority figures are less likely to engage in drinking and driving. In addition, O'malley and Johnston (1999) find that individuals with low commitment to religion are more likely to drive after (heavy) drinking. In summary, existing literature suggests that impaired driving is most prevalent among males, young people, employed, non-religious, and non-married individuals. However, the association between education level, income, and impaired driving is less definitive.

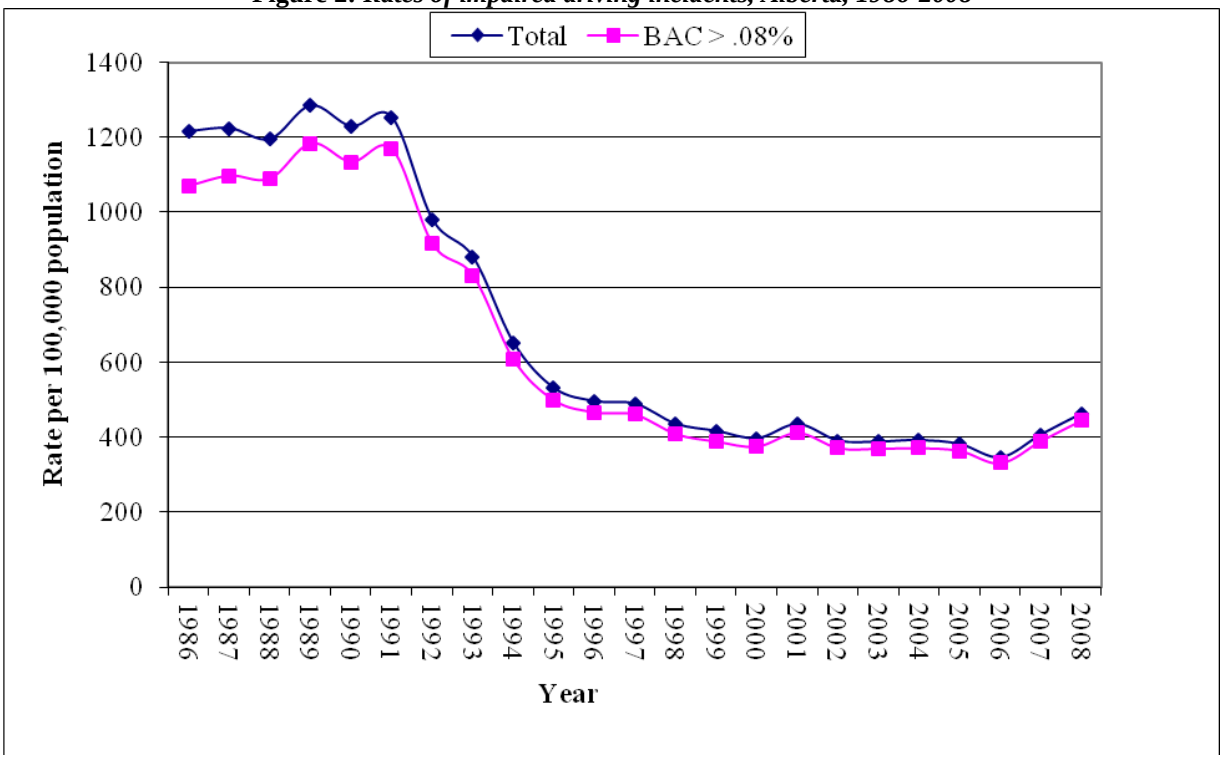
The province of Alberta has one of the highest impaired driving rates in Canada, but it is declining. Over the years, Alberta's impaired driving rate has remained second highest in Canada preceded by Saskatchewan, and followed by Prince Edward Island (see Figure 1). Longitudinal data from Statistics Canada indicate that the rates of impaired driving incidents have decreased from 1,070 per 100,000 population in 1986 to 444 per 100,000 population in 2008 (see Figure 2). Figure 2 also illustrates a general increase in impaired driving rates from 1986 to 1991, peaking at 1,168 per 100,000 population in 1991, followed by sharp decline in the subsequent years, and remaining relatively stable during 1998 onwards. This may be the result of strict rules enforcement by the Alberta Government (e.g., Alberta Administrative License Suspension (AALS) program, zero alcohol tolerance for those who are under Graduated Driver Licensing (GDL) program, fine, impounding vehicles, and jail sentence, etc.). According to Alberta Transportation (2009), in 2008, alcohol-related impaired driving was a contributing factor in 22.5 percent of fatal collisions in Alberta (compared to 5.3 percent of injury collisions). On average, approximately 7,700 people are convicted of impaired driving in Alberta each year (Alberta Transportation, 2009). However, Alberta Transportation (2009) report that traffic fatalities have decreased 10.5 percent from 458 fatalities in 2007 to 410 in 2008, and traffic injuries have also dropped 10.3 percent from 24,530 injuries in 2007 to 22,015 in 2008, which is the lowest number of total casualties since 1995.

Figure 1: ***Rates of impaired driving*, by province, 1986-2008***



Note: * BAC level more than 0.08% mg.
Source: Statistics Canada, Uniform Crime Reporting Survey, CANSIM Table 252 0013

Figure 2: ***Rates of impaired driving incidents, Alberta, 1986-2008***



Source: Statistics Canada, Uniform Crime Reporting Survey, CANSIM Table 252 0013

Research Questions

The current study explores the changes in impaired driving due to alcohol consumption among Edmontonians between 1991 and 2009. The study aims to answer the following two questions: (a) has the prevalence of drinking and driving changed over time among Edmontonians?, and (b) has there been a shift in the impact of standard demographic predictors (gender, marital status, age, income, education etc.) on alcohol-impaired driving in Edmonton, Alberta since 1991? For instance, in 1991, males were three times more likely than females to report alcohol-impaired driving (Nurullah, 2010b). Given the increase of female participation in workforce (621,700 in 1991 versus 957,500 in 2009) and the number of female licensed drivers in recent years (1.13 million in 2005 versus 1.26 million in 2009), is impaired driving still more prevalent among males in 2009?

The current study contributes significantly to our understanding of alcohol-impaired driving in Alberta in several ways. Although previous studies address demographic factors associated with alcohol-impaired driving, they rarely examine changes in the impact of standard socio-economic and demographic factors (gender, marital status, age, income, education etc.) on alcohol-impaired driving over time. It is important to explore these factors as there has been demographic transition in Alberta since 1991 (see: Nurullah, 2010b), which may have leveled the gap between males and females in alcohol-impaired driving. This research also contributes to an enhanced understanding of the changes in alcohol-impaired driving over time in a general population. Previous studies have predominantly employed college student samples, and were primarily cross-sectional in nature, which limit generalizability of the findings to the general population. Furthermore, based on the findings of this study, the effectiveness of current intervention strategies and legislative enforcement to reduce alcohol-impaired driving is examined, which will help policymakers to devise better plans to minimize the problem.

Methods

Data

The data for the present study are obtained from the annual Alberta Surveys conducted in *1991, 1992, 1997,* and *2009,* by the Population Research Laboratory (PRL) at the University of Alberta. These are the only years the Alberta Surveys collected data on impaired driving. The data come from random sample cross-sectional surveys of households in the province of Alberta. The respondents are selected based on a Random-Digit Dialing (RDD) approach to ensure that everyone has an equal chance of being contacted. Data are collected using computer assisted telephone interview (CATI) technology. The survey instrument for each year consisted of the following components: (1) a standardized introduction; (2) questions that reflect the specific research interests of the researchers and agencies conducting the study; and (3) demographic questions.

Sample and Procedure

It is important to note that due to unavailability of data on alcohol-impaired driving for the whole province of Alberta in 1991, 1992, and 1997, the analyses are limited to the sample in the Edmonton metropolitan area. The sample is comprised of 491 participants from Edmonton for the 1991 Alberta Survey, 456 participants for the 1992 Alberta Survey, and 403 participants for each of the 1997 and 2009 Alberta Surveys. For each survey year, the questionnaire is pre-tested by trained interviewers on a number of households (between 20 and 53), and some of the questions are modified based on the feedback provided by the respondents prior to the main phase of data collection. The mean length of the interview for each year is between 20 and 27 minutes. Details on the data collection procedure and sample composition are discussed elsewhere (Nurullah, 2010b).

The overall response rates are: 71.1% in 1991, 74.1% in 1992, 62.9% in 1997, and 28.1% in 2009. It should be noted that in recent years response rates for general household surveys are declining (Tourangeau, 2004). Changes in the telecommunications environment, including increased use of caller ID, answering machines, and cell phones, and the introduction of "do not call" lists are likely factors contributing to low response rate (Shults, Kresnow, & Lee, 2009). For instance, the overall response rate for the Alberta Surveys were 73.0% in both 1993 and 1994, 64.0% in 1996, 58.0% in 1998, 54% in 1999, 42.5% in 2006, 36.5% in 2007, and 28.5% in 2008. The low response rate in the current survey should be considered in the context of declining response rates for various types of surveys (Tourangeau, 2004). However, it is often not possible to determine whether a non-response bias exists (Keeter, Miller, Kohut, Groves, & Presser, 2000; see also limitations section). Despite the low response rate in 2009, Figure 2 as well as data on injuries and death (see: Nurullah, 2010b, Figure 3) reveals similar declining trends comparable to the self-report data used in this study.

Instruments

Drinking and driving

Impaired driving is measured on a dichotomous 'yes' and 'no' scale, assessing alcohol use and impaired driving, designated driver for impaired driving, and riding with an impaired driver. In 1991, 1992, and 2009 Alberta Surveys, the respondents are asked: "In the past 12 months, have you driven while impaired? (over the legal BAC limit of 0.08%)," with the response options of 'yes' and 'no'. However, in the1997 Alberta Survey, the respondents are asked: "Over the last year, how often have you driven while impaired?," with the response options of 'never', 'once or twice', and 'more than twice'. The answers are then dichotomized as follows: never = 'no'; once or twice and more than twice = 'yes'. Furthermore, all the 1991, 1992, and 2009 Alberta Surveys (with the exception of the 1997 Alberta Survey) ask the respondents: "In the past 12 months, have you been a passenger in a vehicle where the driver was

impaired?", "In the past 12 months, have you been in a situation where a designated driver took you home?", and "In the past 12 months, have you been a designated driver for a group?" A designated driver is usually defined as: "A person who agrees to abstain from drinking alcohol and drives for one or more persons who have consumed alcohol" (Barr & MacKinnon, 1998: 549).

Self-reported data regarding a socially and legally offensive behavior such as impaired driving is likely to be underreported. One way to prevent the 'social undesirability bias' in reporting is to be indirect and ask passengers about their frequency of riding with an impaired driver (Dellinger, Bolen, & Sacks, 1999). Soderstrom et al. (1996) investigate the BAC of driver/ passenger sets in motor vehicle fatalities admitted to a trauma center and find 44 percent of the drivers and 43 percent of the passengers are BAC positive. Similarly, Isaac et al. (1995), using the Fatal Accident Reporting System, find that most alcohol-involved fatally injured drivers are together with the passengers who have also consumed alcohol (nearly 80% cases). Therefore, the validity of impaired driving reports may be similar for drivers and passengers, signifying that asking passengers about riding with an impaired driver may be an important alternative measure of impaired driving (Dellinger, Bolen, & Sacks, 1999).

Demographic information

The Alberta Surveys collect demographic information, including age, gender, education, marital status, employment, annual income, home ownership, and religious status. The specific categories for each of these variables are discussed in the results section.

Analysis

The analyses of data are conducted using all the 1991, 1992, 1997, and 2009 data examining the changes in impaired driving in Edmonton, Alberta from 1991 to 2009. Cross-tabulations, χ^2-test, and *z*-tests are used to compare the demographic differences in impaired driving. Block-wise logistic regression analyses (Peng, Lee, & Ingersoll, 2002) are conducted [since the outcome variable represents dichotomous response categories (yes and no)] to evaluate the factors that predict impaired driving. Odds ratios with 95% confidence intervals (95% CI) are used as summary statistics. Nagelkerke R^2 is used to estimate the variance explained by the models. All reported p values are two-sided; and $p < .05$ is considered significant.

Results

Sample Characteristics: 1991, 1992, 1997, and 2009

Table 1 outlines the characteristics of the samples of adult Edmontonians surveyed in 1991, 1992, 1997, and 2009. Given the Population Research Laboratory employs a quota sampling method to obtain equal proportions of males and females in the Alberta Survey, the gender distribution in each sample is estimated to be similar for each year (Gazso & Krahn, 2008). For example, females represent 50.1%, 50.2%, 50.1%, and 50.1% of the respondents, respectively, in 1991, 1992, 1997, and 2009.

The 2009 sample is older, on average, than the 1991 and 1997 samples. For instance, 12.8%, 11.0%, and 13.2% of the respondents are 65 years of age and older in 1991, 1992, and 1997, respectively, compared to 21.9% of the respondents in 2009. On the other hand, the proportion of younger respondents (aged between 18 and 24) has decreased over the years, from 17.5% in 1991 to 7.3% in 2009. The older 2009 sample reveals the fact that, like the Canadian population, the Alberta population is gradually aging (Gazso & Krahn, 2008). The 2009 samples include more married or cohabiting couples compared to the 1991, 1992, and 1997 sample. For example, 65.5% of the respondents are either married or cohabiting in 2009, compared to 54.7%, 50.3%, and 48.6% of the respondents in 1991, 1992, and 1997, respectively. On the other hand, the proportion of single respondents has increased from 26.5% in 1991 to 35.1% in 1997, but decreased to 19.0% in 2009.

The 2009 sample is also better educated, with 47.1% of the respondents having university degrees in 2009, compared to 20.6%, 19.8%, and 24.8% of the respondents in 1991, 1992, and 1997, respectively. On the other hand, the representation of respondents with less than high-school education has decreased from 18.4% in 1991 to 2.7% in 2009. While employment status of the respondents remain relatively analogous between 1991 and 2009 (except in 1997), the 2009 sample is somewhat more affluent. For instance, only 5.9%, 4.5%, and 7.3% of the respondents individually earn $60,000 and above per year in 1991, 1992, and 1997, respectively, compared to 17.7% in 2009. Note that the income data for 1997 and 2009 are adjusted for inflation based on the Bank of Canada inflation calculator. A similar trend is revealed in the annual household income of the respondents. This increase is probably largely due to inflation over the previous 12 years, although it may also represent a small increase in real incomes in Alberta. Table 1 also illustrates the religious and home ownership/renting pattern of the respondents. In 2009, 26.6% of the respondents have no religion, compared to 20.0%, 17.2%, and 21.0% of the respondents, in 1991, 1992, and 1997 respectively. Finally, in recent years, more respondents (or their spouse/ parents) own a house (79.5% in 2009), compared to 1991, 1992, and 1997 (49.1%, 51.1%, and 57.4%, respectively).

Changes in Impaired Driving Over Time

Table 2 illustrates the changes in the self-reported alcohol-impaired driving (over the legal BAC limit) over time in Edmonton, Alberta from 1991 to 2009. Between 1991 and 2009, self-reported alcohol-impaired driving in the past 12 months has decreased from 10.6% (95% CI = 7.28–13.78) to 3.7% (95% CI = 1.82–5.58); and the difference is statistically significant ($z = 3.483$, $P < .001$). This declining trend is demonstrated further in Figure 3. The self-reported rate of being a passenger in a vehicle with an impaired driver in the past 12 months has also decreased from 10.9% (95% CI = 7.51–14.07) in 1991 (with 1.0% increase in 1992) to 5.2% (95% CI = 2.99–7.41) in 2009; and the difference is statistically significant ($z = 2.671$, $P < .01$).

Table 2 also shows that the rate of being taken home by a designated driver in the past 12 months has remained relatively stable over time. For example, 23.8% (95% CI = 19.4–28.42) of the respondents in 1991, 31.4% (95% CI = 26.26–36.32) of the respondents in 1992, and 27.1% (95% CI = 22.70–31.56) of the respondents in 2009 have indicated that they have been in a situation where designated drivers took them home. Similarly, the rate of being a designated driver for a group in the past 12 months has changed only slightly. For instance, 36.9% (95% CI = 31.63–41.83) of the respondents in 1991, 43.6% (95% CI = 38.18–48.94) of the respondents in 1992, and 37.0% (95% CI = 32.19–41.81) of the respondents in 2009, indicated that they have been designated drivers for a group. However, the rate of changes in designated driving over the years is not statistically significant.

Socio-demographic Differences in Impaired Driving

The findings presented in Table 3 illustrate the socio-demographic differences across population subgroups in the rate of impaired driving over time in Edmonton, Alberta from 1991 to 2009. In 1991, statistically significant differences are observed only for gender, age, employment, and individual income. Male respondents are considerably more likely (16.4%) than female respondents (4.9%) to admit to alcohol-impaired (over the legal BAC limit) driving ($p < .001$). Individuals aged 55 years and older are least likely (only 2.0%) to report “driving while impaired” in 1991, compared to those aged between 18 and 34 (12.7%) and between 35 and 54 years of age (13.0%) ($p < .01$). Currently employed (both full-time and part-time) individuals are more likely (13.3%) than currently unemployed individuals (5.4%) to report “driving while impaired” ($p < .01$). Furthermore, respondents with the lowest annual individual income (< $30,000 per year) are about 50% less likely than those with higher incomes (7.7% versus 16.0%) to report “driving while impaired” ($p < .05$). However, the differences between subgroups of the sample in marital status, education, religious status, and home ownership are not statistically significant.

Table 1:

Sample Characteristics from the Alberta Surveys 1991, 1992, 1997 and 2009 (Edmonton)

Characteristics	1991 (*N* = 491)	1992 (*N* = 456)	1997 (*N* = 403)	2009 (*N* = 403)
Gender				
Male	49.9	49.8	49.9	49.9
Female	50.1	50.2	50.1	50.1
Age				
18-24	17.5	15.6	17.5	7.3
25-34	30.8	32.7	20.1	14.8
35-44	22.2	17.5	26.4	16.9
45-54	9.2	14.0	15.0	22.9
55-64	7.5	9.2	7.9	16.1
65+	12.8	11.0	13.2	21.9
Marital Status				
Never married	26.5	30.1	35.1	19.0
Married/ Cohabiting	54.7	50.3	48.6	65.5
Divorced/ Widowed/ Separated	18.8	19.6	16.3	15.5
Education				
Less than high-school	18.4	21.1	15.5	2.7
Completed high-school	18.6	18.2	20.3	20.3
Some post-secondary	42.4	40.9	39.5	29.8
Post-secondary certificate	20.6	19.8	24.8	47.1
Employment				
Employed (full-time & part-time)	66.1	62.9	68.0	62.8
Not currently employed/Retired	33.9	37.1	32.0	37.2
Annual Individual Income				
Up to $29,999	64.5	63.1	59.0	42.1
$30,000 to $59,999	29.6	32.3	33.7	40.2
$60,000 to $100,000+	5.9	4.5	7.3	17.7
Annual Household Income				
Up to $29,999	34.2	33.2	28.8	14.6
$30,000 to $59,999	40.6	39.2	37.8	34.7
$60,000 to $100,000+	25.2	27.6	33.4	50.6
Religion				
No religion	20.0	17.2	21.0	26.6
Roman Catholic	28.0	25.6	30.4	21.2
Other Christian	46.2	50.3	42.5	40.6
Jews, Muslims, & others	5.8	6.8	6.1	11.6
Home Ownership				
Own (self/ spouse/ parents)	49.1	51.1	57.4	79.5
Rent	50.9	48.9	42.6	20.5

Table 2:

Impaired driving rate in Edmonton, Alberta: 1991 to 2009

Characteristics	1991 Y %	1992 Y %	1997 Y %	2009 Y %
Driven while impaired[1 a]	10.6***	8.4*	7.2	3.7
(95% CI)	(7.28–13.78)	(5.39–11.41)	(4.20–10.20)	(1.82–5.58)
Passenger in a vehicle with impaired driver[2 b]	10.9**	11.9**	n.a.	5.2
(95% CI)	(7.51–14.07)	(8.44–15.48)		(2.99–7.41)
A designated driver took the person home [3]	23.8	31.4	n.a.	27.1
(95% CI)	(19.4–28.42)	(26.26–36.32)		(22.70–31.56)
Being a designated driver for a group[4]	36.9	43.6	n.a.	37
(95% CI)	(31.63–41.83)	(38.18–48.94)		(32.19–41.81)

Note: N for the years ranged from 400 to 491. CI = Confidence Interval.

Y % = Percentage of individuals saying "yes" to the question.

n.a. = Data unavailable for year.

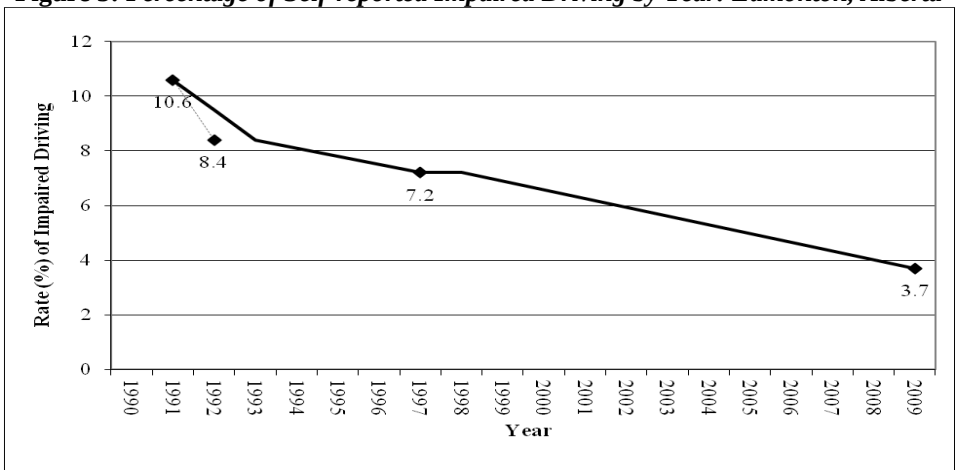
* $p < .05$, ** $p < .01$, *** $p < .001$. Statistically significant difference in proportions from 2009.
1. "In the past 12 months, have you driven while impaired?" (In 1997 Alberta Survey, the question was worded as: "Over the last year, how often have you driven while impaired?")

2. "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?"

3. "In the past 12 months, have you been in a situation where a designated driver took you home?"

4. "In the past 12 months, have you been a designated driver for a group?"
a. Impaired driving rate in 2009 is significantly different from that of 1991 ($z = 3.483$, $P < .001$) and 1992 ($z = 2.524$, $P < .05$), but not that of 1997 ($z = 1.846$, $P = .065$).
b. The rate of being a passenger in a vehicle with impaired driver in 2009 is significantly different from that of 1991 ($z = 2.671$, $P < .01$) and 1992 ($z = 3.127$, $P < .01$).

Figure 3: ***Percentage of Self-reported Impaired Driving by Year: Edmonton, Alberta***



Source: Annual Alberta Surveys 1991, 1992, 1997, and 2009: Population Research Laboratory, U of Alberta.

Table 3:

Impaired driving by demographic characteristics: Edmonton, Alberta, 1991 to 2009

Characteristics	1991 Y %	1992 Y %	1997 Y %	2009 Y %
Total	***10.6***	***8.4***	***7.2***	***3.7***
Gender	***	***	**	
Male	16.4 # 1	13.3 # 19	11.1 # 32	5.0
Female	4.9	3.5	3.5	2.5
Age [a]	**	*	*	
18-34	12.7 # 2	9.2 # 20	9.5 # 33	4.8
35-54	13.0 # 3	11.1 # 21	9.3 # 34	2.6
55-65+	2.0 # 4	2.2 # 22	0.0	4.8
Marital Status [a]				
Non married	12.2 # 5	10.8 # 23	8.3	4.4
Married	9.4 # 6	6.1	6.2	3.5
Education [a]			*	
High-school or less	11.6 # 7	8.9 # 24	3.5	4.3
Post-secondary	10.1 # 8	8.1 # 25	9.4 # 35	3.6
Employment	**		*	
Employed	13.3 # 9	9.5 # 26	9.2 # 36	4.0
Not currently employed	5.4	6.0	3.1	3.4
Annual Individual Income	*			
Up to $29,999	7.7	8.0	5.9	4.9
$30,000 to $59,999	16.7 # 10	9.5 # 27	9.5 # 37	4.8
$60,000 to $100,000+	16.0 # 11	0.0	8.7 # 38	4.2
Annual Household Income				
Up to $29,999	8.0 # 12	7.7 # 28	4.8	3.1
$30,000 to $59,999	13.5 # 13	10.2 # 29	8.3 # 39	3.5
$60,000 to $100,000+	10.9 # 14	7.1	7.3	4.9
Religious Status [a]		***		
Religious	10.0 # 15	6.2	6.4	3.2
Not religious	13.4 # 16	19.5 # 30	11.0	5.9
Home Ownership				
Own	7.9 # 17	6.5	6.2	4.2
Rent	13.3 # 18	10.0 # 31	7.7 # 40	2.5

Note: N for the years ranged from 287 to 491.

Y % = Percentage of individuals saying "yes" to the impaired driving question.

a. Re-categorized to meet the sample requirement for cross-tabulation.

Pearson Chi-square test: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3: ***(continued)***

Statistically significant difference in proportions from 2009:

1. $z = 5.224$, $P < .001$
2. $z = 3.941$, $P < .001$
3. $z = 5.493$, $P < .001$
4. $z = 2.162$, $P < .05$
5. $z = 4.004$, $P < .001$
6. $z = 3.374$, $P < .01$
7. $z = 3.825$, $P < .001$
8. $z = 3.563$, $P < .001$
9. $z = 4.672$, $P < .001$
10. $z = 5.486$, $P < .001$
11. $z = 5.562$, $P < .001$
12. $z = 2.998$, $P < .01$
13. $z = 5.063$, $P < .001$
14. $z = 3.077$, $P < .01$
15. $z = 3.850$, $P < .001$
16. $z = 3.616$, $P < .001$
17. $z = 2.133$, $P < .05$
18. $z = 5.642$, $P < .001$
19. $z = 4.077$, $P < .001$
20. $z = 2.373$, $P < .05$
21. $z = 4.753$, $P < .001$
22. $z = 2.073$, $P < .05$
23. $z = 3.336$, $P < .01$
24. $z = 2.545$, $P < .05$
25. $z = 2.617$, $P < .05$
26. $z = 3.046$, $P < .01$
27. $z = 2.524$, $P < .05$
28. $z = 2.808$, $P < .05$
29. $z = 3.647$, $P < .001$
30. $z = 5.793$, $P < .001$
31. $z = 4.305$, $P < .001$
32. $z = 3.159$, $P < .01$
33. $z = 2.524$, $P < .05$
34. $z = 3.966$, $P < .001$
35. $z = 3.245$, $P < .01$
36. $z = 2.895$, $P < .05$
37. $z = 2.524$, $P < .05$
38. $z = 2.457$, $P < .05$
39. $z = 2.801$, $P < .05$
40. $z = 3.260$, $P < .01$

In 1992, the overall rate of impaired driving in the past year declines slightly to 8.4% from 10.6% in 1991, and the difference is statistically significant ($z = 2.524$, $P < .05$). Statistically significant differences exist only for gender, age, and religious status. Male respondents are considerably more likely (13.3%) than female respondents (3.5%) to report "driving while impaired" ($p < .001$), a trend which is similar to 1991. Respondents aged 55 years and older are least likely (only 2.2%) to report drinking and driving in 1992, compared to those aged between 18 and 34 (9.2%) and between 35 and 54 years of age (11.1%) ($p < .05$); this trend is also similar to 1991. Those without religion are considerably more likely (19.5%) than those with religion (6.2%) to report "driving while impaired" ($p < .001$). However, the differences between subgroups of the sample in marital status, education, employment, income, and home ownership are not statistically significant.

By 1997, the overall rate of impaired driving drops slightly to 7.2%. Statistically significant differences exist only for gender, age, education, and employment. Male respondents are more than three times as likely as female respondents (11.1% vs. 3.5%) to report legally impaired driving ($p < .01$). Respondents between 18 and 54 are more likely to report "driving while impaired" (over 9%) compared to those aged 55 years and older (0.0%) ($p < .05$). Those with post-secondary education are more likely (9.4%) to report "driving while impaired" compared to those with high-school education or less (3.5%) ($p < .05$). Furthermore, currently employed (both full-time and part-time) individuals are more likely (9.2%) than currently unemployed/retired individuals (3.1%) to report "driving while impaired" ($p < .05$). By 2009, none of the differences across population subgroups in responses are statistically significant.

Table 3 also highlights that between 1991 and 2009, the rate of alcohol-impaired driving in Edmonton, Alberta has declined in every population subcategory surveyed, except for age (55 years and above). All but three (i.e., females, not currently employed, and annual individual income of $30,000 or less) of the differences over time are statistically significant. With regard to the rate of change over time, self-reported alcohol-impaired driving declines the most among males (16.4% in 1991 vs. 5.0% in 2009, $z = 5.224$, $p < .001$), the younger (12.7% in 1991 vs. 4.8% in 2009, $z = 3.941$, $p < .001$) and mid-aged (age 35 to 54) respondents (13.0% in 1991 vs. 2.6% in 2009, $z = 5.493$, $p < .001$). The rate of impaired driving also declines the most among non-married (12.2% in 1991 vs. 4.4% in 2009, $z = 4.004$, $p < .001$), employed (13.3% in 1991 vs. 4.0% in 2009, $z = 4.672$, $p < .001$), and religious respondents (10.0% in 1991 vs. 3.2% in 2009, $z = 3.850$, $p < .001$). In addition, the rate of impaired driving declines the most among those with post-secondary education (10.1% in 1991 vs. 3.6% in 2009, $z = 3.563$, $p < .001$), those with higher annual individual income (16.0% in 1991 vs. 4.2% in 2009, $z = 5.562$, $p < .001$), and those who live in a rented house (13.3% in 1991 vs. 2.5% in 2009, $z = 5.642$, $p < .001$). Furthermore, the

impaired driving rate increases gradually from 2.0% in 1991 to 2.2% in 1992, to 4.8% in 2009 among the older population (age 55 years and above) ($p < .05$).

Table 4:

Logistic Regression Analysis Predicting Impaired driving: Edmonton, Alberta, 1991

Variables	Model χ^2	*b*	Wald χ^2	Odds Ratio	95% CI	
					Lower	Upper
Model 1: Main effect	41.26 (12 df)***					
Gender (male = 1)		1.19	9.07	3.29**	1.52	7.16
Age						
18-34		1.27	2.48	3.56	0.73	17.31
35-54		1.34	2.71	3.83	0.78	18.90
55-65+ (ref)						
Marital Status (not married = 1)		0.14	0.16	1.15	0.58	2.28
Education						
Less than high-school		0.08	0.02	1.08	0.30	3.84
Completed high-school		1.13	4.72	3.10*	1.12	8.61
Some post-secondary		0.44	0.84	1.55	0.61	3.96
Post-secondary certificate (ref)						
Employment (employed = 1)		0.11	0.06	1.12	0.46	2.70
Religious Status (not religious = 1)		0.35	0.80	1.41	0.66	3.01
Home Ownership (own = 1)		-0.95	5.49	0.39*	0.18	0.86
Annual Individual Income						
Up to $29,999 (ref)						
$30,000 to $59,999		0.81	4.29	2.25*	1.04	4.86
$60,000 to $100,000+		1.03	2.17	2.80	0.71	11.01
Constant = -4.72***	–2 Log likelihood = 249.44					
Cox & Snell R^2 = .09	Nagelkerke R^2 = .19					

Variables	Model χ^2	*b*	Wald χ^2	Odds Ratio	95% CI	
					Lower	Upper
Model 2: Interaction	43.12 (14 df)***					
Gender x Age						
18-34		1.73	1.22	5.66	0.26	122.98
35-54		0.88	0.31	2.41	0.11	54.96
55-65+ (ref)						
Constant = -3.87**	–2 Log likelihood = 247.58					
Cox & Snell R^2 = .10	Nagelkerke R^2 = .19					

Note: $N = 422$. CI = confidence interval.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 5:

Logistic Regression Analysis Predicting Impaired driving: Edmonton, Alberta, 2009

Variables	Model χ^2	*b*	Wald χ^2	Odds Ratio	95% CI	
					Lower	Upper
Model 1: Main effect	11.67 (12 df)					
Gender (male = 1)		0.35	0.33	1.42	0.42	4.77
Age						
18-34		-0.42	0.25	0.65	0.13	3.43
35-54		-1.36	2.67	0.26	0.05	1.31
55-65+ (ref)						
Marital Status (not married = 1)		0.33	0.31	1.39	0.44	4.40
Education						
Less than high-school		2.41	3.94	11.17*	0.78	161.06
Completed high-school		1.02	1.45	2.78	0.53	14.69
Some post-secondary		1.62	4.82	5.03*	1.19	21.30
Post-secondary certificate (ref)						
Employment (employed = 1)		0.40	0.29	1.49	0.35	6.34
Religious Status (not religious = 1)		0.87	1.88	2.38	0.69	8.24
Home Ownership (own = 1)		0.68	0.64	1.98	0.37	10.59
Annual Individual Income						
Up to $29,999 (ref)						
$30,000 to $59,999		0.07	0.01	1.07	0.27	4.28
$60,000 to $100,000+		0.82	0.73	2.28	0.35	14.96
Constant = -4.98***	–2 Log likelihood = 108.75					
Cox & Snell R^2 = .04	Nagelkerke R^2 = .11					

Variables	Model χ^2	*b*	Wald χ^2	Odds Ratio	95% CI	
					Lower	Upper
Model 2: Interaction	11.89 (14 df)					
Gender x Age						
18-34		0.60	0.17	1.83	0.10	33.66
35-54		0.53	0.13	1.70	0.10	29.74
55-65+ (ref)						
Constant = -4.73***	–2 Log likelihood = 108.52					
Cox & Snell R^2 = .04	Nagelkerke R^2 = .12					

Note: N = 313. CI = confidence interval.

*p < .05, ***p < .001.

Predicting Impaired Driving: 1991 and 2009

In order to assess the net effects of predictors of impaired driving in Edmonton, Alberta in 1991 and 2009, block-wise logistic regression analyses are conducted. Table 4 and 5 display the logistic regression models predicting alcohol-impaired driving in Edmonton, Alberta in 1991 and 2009. As shown in Table 4, the chi-square statistic for model 1 is significant (χ^2 = 41.26 (12 d.f.), $p < .001$), indicating that the socio-demographic variables successfully predict impaired driving in 1991. Investigation of the individual coefficients reveals that gender, education, home ownership, and annual individual income are significant predictors of impaired driving in 1991. Male respondents have 3.29 times greater odds (95% CI = 1.52–7.16) of being impaired drivers, compared to females ($p < .01$). Those with completed high school education have 3.10 times greater odds (95% CI = 1.12–8.61) of being impaired drivers, compared to those with post-secondary credentials ($p < .05$). Those who own their house have 0.39 times lesser odds of being impaired drivers (95% CI = 0.18–0.86), compared to those who live in a rented house ($p < .05$). Respondents with an annual individual income between $30,000 and $59,999 have 2.25 times greater odds of being impaired drivers (95% CI = 1.04–4.86), compared to those with an income of less than $30,000 ($p < .05$). The model explains approximately 19% of the variance in impaired driving (Nagelkerke R^2 = .19).

Given the well-established findings indicating that male and younger respondents are more likely to drink and drive (Holmila & Raitasalo, 2005; Schwartz, 2008; Wechsler et al., 2003), a two-way interaction term between age and gender is created. Model 2 in Table 4 shows that the interaction between age and gender is not statistically significant. Furthermore, adding the interaction term to the model does not result in a significant change in model fit (χ^2 change = 1.86 (2, 12 d.f.), $p = .39$), nor does it account for any significant change in the variance explained in impaired driving (Nagelkerke R^2 remains the same at .19).

However, by 2009, only education status remains a significant predictor of impaired driving. Those with less than high school education have 11.17 times greater odds (95% CI = 0.78–161.06), and those with some post-secondary education have 5.03 times greater odds (95% CI = 1.19–21.30) of being impaired drivers, compared to those with post-secondary credentials ($p < .05$). However, as displayed in Table 5, the chi-square statistic for both model 1 (χ^2 = 11.67 (12 d.f.), $p = .47$) and model 2 (χ^2 = 11.89 (14 d.f.), $p = .61$) is statistically non-significant. In addition, the interaction between age and gender is not statistically significant.

Discussion

A major objective of this study is to examine the changes in alcohol-impaired driving in Edmonton, Alberta from 1991 to 2009. Results indicate that self-reported impaired driving has declined over the years (from 10.6% in 1991 to 3.7% in 2009). The rate of riding with an impaired driver has also decreased from 1991 to 2009. However, there has not been any substantial change in the rate of designated driving (both using a designated driver and being a designated driver for a group). These findings are consistent with the existing literature, as Wallace (2009, p. 25, Table 2) reported that from 1998 to 2008 the overall rate of impaired driving offences reported by police in Canada has dropped by 12 percent. Similarly, using multiple indicators of drinking and driving incidents in Canada from 1998 to 2011, Vanlaar et al. (2012) show that self-reported legally impaired driving rates have declined significantly in recent years. Furthermore, as Figures 1 and 2 indicate, and Brennan and Dauvergne (2011, Chart 14) illustrate, the rate of impaired driving offences has declined considerably from 1980s to 2010 in both Canada and Alberta. As such, this self-reported data on impaired driving in Edmonton are comparable to that of Alberta and Canada.

What may have contributed to the declining rate of impaired driving in Edmonton, Alberta? While it may not be possible to unravel the various causal mechanisms that produce a decrease in the rate of impaired driving in the province, I consider the following several factors. First, the increase in enforcement of legal rulings and regulations against impaired driving (e.g., 0.08 g/dL BAC laws, license

suspension, etc.) for fully-licensed drivers may have contributed to the decline. An evaluation of the Alberta Administrative License Suspension (AALS) program indicates a 19 percent reduction in the recidivism rate for alcohol-involved drivers in casualty collisions, and a 12 percent reduction in the number of fatal collisions involving alcohol in three years after the introduction of the program (Howard Research, 2005). Babor et al. (2010, pp. 103-108) outline several strategies that are effective in reducing alcohol-related problems, which include (a) deterrence, penalty, and social pressure to reduce impaired driving, (b) regulating availability, (c) controlling price and alcohol taxes, and (d) regulating alcohol advertising and marketing.

Second, zero alcohol tolerance for youth who are licensed under the Graduated Driver Licensing (GDL) program may have an impact on the declining rate of impaired driving in the province. Since the implementation of GDL in May 2003, the number of casualty collisions by young new drivers has dropped significantly. For instance, the rate for 18 and 19 year old drivers drops from the pre-GDL level of 30.9 (in 2002) to 20.5 (in 2008) casualty collisions per 1000 licensed drivers (Alberta Transportation, 2009; Alberta Transportation, 2003). Evaluations of GDL programs in the US, Canada, New Zealand, and Australia show strong evidence for reduction in crash rates in all jurisdictions and for all crash types (Hartling, Wiebe, Russell, Petruk, Spinola, and Klassen, 2004; Mayhew, Simpson, & Singhal, 2005; Shope, 2007). In addition, based on data from 46 U.S. States and 11 Canadian jurisdictions, Vanlaar et al. (2009) find strong evidence in support of GDL reducing fatalities (e.g., reduction of 19.1% in the relative fatality risk of 16-year-old drivers).

Third, implementation of DWI/DUI checkpoints or sobriety checkpoints to perform random breath testing could have led to the declining rate of impaired driving. Data are lacking, however, on the extent to which there has been an increase in DWI/DUI checkpoints or sobriety checkpoints in Alberta. Studies find that both random breath-testing (RBT) and selective breath-testing (SBT) checkpoints are effective in reducing alcohol-related crashes and associated fatal and nonfatal injuries (Elder, Shults, Sleet, Nichols, Zaza, & Thompson, 2002; Shults et al., 2001). Fourth, alcohol ignition interlock programs for convicted impaired driving offenders may have contributed to the declining rate of impaired driving. Research shows that interlock devices have led to reduced recidivism by 50% to 90% (Alberta Centre for Injury Control & Research, 2009). Based on combined data from multiple studies, Marques (2009) estimate that interlocks account for 65% reductions in impaired driving recidivism. Fifth, other deterrent factors in impaired driving include fines, impounding vehicles, and jail sentences. It remains unclear, however, as the extent to which these deterrent factors have been increasingly implemented in Alberta.

Finally, there may also have been some impact of nationwide campaigns (e.g., 'Mother's Against Drunk Driving' and 'Arrive Alive Drive Sober') on reducing alcohol-impaired driving in Edmonton, Alberta. In their systematic review of the effectiveness of mass media campaigns, Elder et al. (2004) find a median decrease of 10% in injury crashes. There has been an increase in drug-related impaired driving in recent years in Canada, particularly among young adults (Bédard, Dubois, & Weaver, 2007). Although alcohol-impaired driving is declining in Alberta, drug-related impaired driving may be on the rise. However, future research needs to confirm whether drug-related impaired driving is increasing over the years, and whether there is any causal relationship between the decline in alcohol-impaired driving and the increase in drug-impaired driving in Alberta (if any).

The findings of this study indicate that between 1991 and 2009, the rate of impaired driving (over the legal BAC limit) in Edmonton, Alberta decreases in every socio-demographic segment of the population, except for age (55 years and older). Several important observations can be drawn from the findings. First, the rate of impaired driving has substantially declined among males (from 16.5% in 1991 to 5.2% in 2009) compared to females (from 4.7% in 1991 to 2.6% in 2009), although males continue to be more likely than females to drive while impaired. Why is the decrease in impaired driving among females less prevalent? Part of the explanation is that the rate of impaired driving in females was lower to begin with. While the current data or previous studies do not provide a clear answer to this question, research has suggested some intriguing explanations. In a qualitative study conducted among 16 male and 16 females (aged 20-29 years) in New Zealand, Lyons and Willott (2008) find that on the one hand, women's drinking is linked to pleasure and fun, particularly among those who are frequently intoxicated;

and on the other hand, drunk women are positioned as deviant and breaking traditional codes of femininity. Holmila and Raitasalo (2005) assert that gender difference in alcohol-impaired driving behavior still remains largely unexplained, even though it may be linked with many aspects of biological differences between men and women, of gender-specific roles, and of ways in which environment regulate peoples' drinking.

Fourth, the findings indicate that the rate of impaired driving has increased among older samples (age between 55 and above), but has decreased among young people from 1991 to 2009. This finding raises questions whether there is a shift in age related impaired driving among Edmontonians in recent years. If so, what may have contributed to the increasing rate of impaired driving among this group of population? The current data do not allow for a plausible explanation on this issue. However, it may be that the current impaired driving policy target mostly the young people (e.g., graduate driver licensing, minimum legal drinking age laws etc.), but not the older ones. In addition, the cohort-effect may play a role in this context. It may be that the individuals aged 55 and older had had higher alcohol consumption rate when they were young, a trend that may have developed into alcohol-dependence continuing later in their life. Furthermore, the reason for the increased rate of impaired driving among individuals aged 55 and older may be due to the increased representation of older population and decreased representation of younger population in the Alberta Surveys in recent years. Finally, the rate of impaired driving has significantly declined (based on *z*-test for proportions) the most among the non-married, employed, religious respondents, those with post-secondary education, those with higher annual individual income, and those who live in a rented house.

Limitations and Future Direction

The current study has several limitations. The ethnic compositions in Alberta Survey represent large number of mixed-racial and Caucasian, and small number of non-Caucasian (Asians, aboriginals, and others) samples. Given the small number of cases for impaired driving in Alberta, conducting statistical analysis in identifying the differences within different ethnic groups is not feasible. It is important, however, to make such comparison to broadly understand the prevalence of impaired driving in the province. The results of this study should be interpreted with caution, because low response rate in 2009 Alberta Survey may have compromised the overall representativeness of the sample. However, low response rates in RDD studies do not necessarily cause non-response bias, and it is often not possible to determine whether a non-response bias exists (Groves, 2006; Keeter et al., 2000; Merkle & Edelman, 2002). Studies on non-response rates and non-response bias have shown that there is no strong association between non-response rates and non-response bias (Curtin, Presser, & Singer, 2000; Merkle & Edelman, 2002). To ensure minimization of bias due to non-response, up to ten callback attempts are made per sample. In addition, to ensure refusal rates are lowest, the respondents are informed that their responses will be kept completely confidential and anonymous, that the nature of the survey is non-commercial, and that the data is being collected in accordance with the Alberta Freedom of Information and Protection of Privacy Act (Nurullah, 2010b).

The current study has left many questions unanswered. Future research should explore additional questions, for instance, why does impaired driving continue to prevail? Are drivers resorting to cannabis and other drugs, while reducing the use of alcohol? The next wave of the Canadian Addiction Survey and other surveys can shade light on such questions. Future studies should compare the rate of impaired driving among different ethnic groups in Alberta. To my knowledge, no study has focused on ethnic differences in the rate of impaired driving among Albertans so far. Ethnicity has been one of the factors linked to impaired driving in a few U.S. and Canadian studies (Asbridge, Payne, Cartwright, & Mann, 2010; Caetano & McGrath, 2005). In a representative sample of Ontario adults aged 18 and older who represented 19 distinct ethnic groups based on their self-identification of ethno-cultural heritage, Asbridge et al. (2010) find that relative to other ethnic groups, those adults who identify as Irish have a significantly higher rate of alcohol-impaired driving, while those of Italian and Chinese ethnicity have significantly lower rates of alcohol-impaired driving.

Policy Implications

Based on the findings of the study, several policy implications can be outlined. Although the rate of impaired driving is declining in recent years in Alberta, it still remains a major problem contributing to collision and injuries in the province. Policies should be directed towards gradually alleviating the problem. There is a gendered dimension in impaired driving. Although the rate of impaired driving has declined more among males (the rate of decline in females is lower), impaired driving still remains more prevalent among males than among females. Policies on reducing impaired driving should address this gendered nature of the phenomenon. A possible strategy is to target both males and females, rather than males only (which had been the sole target for impaired driving prevention, given that in all studies conducted so far, the behavior remains higher in males). Furthermore, implementing effective interventions to prevent binge drinking could substantially reduce alcohol-impaired driving (Flowers et al., 2008). Passengers of drinking drivers are at as much risk of a motor vehicle crash as the driver. However, the current legislation does not address the passengers of impaired drivers. Therefore, prevention efforts to reduce the rate of drinking and driving behavior should include passengers. The findings indicate that the use of designated drivers in Alberta remain literally unchanged for long. However, designated driving service is one of the most efficient strategies to reduce impaired driving, provided that the designated drivers remain sober when they perform their duty (Ditter et al., 2005). Therefore, the government of Alberta should take the initiative to improve the designated driving service in the province.

Acknowledgements: This paper is based in part on my MA Thesis. The research is supported by a REID (Research and Education on Impaired Driving) grant provided through the Department of Sociology at the University of Alberta. I'd like to thank Harvey Krahn, Michael Haan, and Cam Wild for their helpful suggestions and mentorship, and to the anonymous referees for their invaluable comments. An earlier version of this paper was presented at the *Canadian Sociological Association Annual Meeting* in Montréal, 31 May–04 June 2010.

About the Author: Abu Sadat Nurullah is currently a PhD candidate in Sociology at the University of Alberta. He has published in the *Journal of Communication Studies*, *Research in the Social Scientific Study of Religion*, *American Journal of Islamic Social Sciences,* and *International Journal of Interdisciplinary Social Sciences*, among others. His research interests include social problems, Islamic sociology, new media and society, and sociology of health and wellbeing. Direct correspondence to:
Abu Sadat Nurullah, Department of Sociology, 5-21 Tory Building, University of Alberta, Edmonton, Alberta, T6G 2H4. E-mail: nurullah@ualberta.ca

References

Adebayo, A. (1991). Factors antecedent to impaired driving in a Canadian urban sample. *International Journal of the Addictions*, *26*(8), 897-909.

Adlaf, E. M., Mann, R. E., & Paglia, A. (2003). Drinking, cannabis use and driving among Ontario students. *Canadian Medical Association Journal*, *168*(5), 565-566.

Adrian, M., Ferguson, B. S., & Her, M. (2001). Can alcohol price policies be used to reduce drunk driving? Evidence from Canada. *Substance Use & Misuse*, *36*(13), 1923-1957.

Alberta Alcohol and Drug Abuse Commission. (2006). *Canadian Addiction Survey 2004: Alberta report*. Edmonton, Alberta, Canada: Author.

Alberta Centre for Injury Control & Research (2009). Lowering the legal blood alcohol concentration for drivers. Retrieved on March 30, 2010, from http://www.acicr.ualberta.ca/documents/BAC_PositionStatementDec09_References.pdf

Alberta Transportation (2009). Alberta traffic collision statistics 2008. Retrieved on August 14, 2010, from http://www.transportation.alberta.ca/Content/docType47/Production/2008AR.pdf

Alberta Transportation (2003). Alberta traffic collision statistics 2002. Edmonton, AB: Government of Alberta. Retrieved on March 30, 2010, from http://www.transportation.alberta.ca/Content/docType47/Production/2002AR.pdf

Asbridge, M., Payne, E., Cartwright, J., & Mann, R. E. (2010). Driving under the influence of alcohol: Examining ethno-specific rates and the mediating effects of psychological distress and harmful and problematic drinking. *Accident Analysis & Prevention, 42*(4), 1408-1415.

Babor, T. F., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K. et al. (2010). *Alcohol: No ordinary commodity—Research and public policy* (2nd ed.). New York: Oxford University Press.

Barr, A., & MacKinnon, D. P. (1998). Designated driving among college students. *Journal of Studies on Alcohol, 59*(5), 549-555.

Bédard, M., Dubois, S., & Weaver, B. (2007). The Impact of Cannabis on Driving. *Canadian Journal of Public Health, 98*(1), 6-11.

Beirness, D. J., & Davis, C. G. (2007). Driving after drinking in Canada: Findings from the Canadian Addiction Survey. *Canadian Journal of Public Health, 98*(6), 476-480.

Beirness, D. J., Simpson, H. M., Mayhew, D. R., & Wilson, R. J. (1994). Trends in drinking driver fatalities in Canada. *Canadian Journal of Public Health, 85*(1), 19-22.

Belton, K. L., Jhangri, G. S., MacDonald, S. D., & Voaklander, D. C. (2005). Nighttime impaired driving in rural Alberta. *Journal of Agricultural Safety and Health, 11*(2), 135-140.

Borges, G., Cherpitel, C., Orozco, R., Bond, J., Ye, Y., & Macdonald, S. (2006). Multicenter study of acute alcohol use and non-fatal injuries: Data from the WHO collaborative study on alcohol and injuries. *Bulletin of World Health Organization, 84*(6), 453-460.

Brennan, S., & Dauvergne, M. (2011). Police-reported crime statistics in Canada, 2010. *Juristat*, Statistics Canada catalogue no. 85-002-X. Ottawa: Canadian Centre for Justice Statistics, Statistics Canada.

Caetano, R., & McGrath, C. (2005). Driving under the influence (DUI) among U.S. ethnic groups. *Accident Analysis & Prevention, 37*(2), 217-224.

Curtin, R., Presser, S., & Singer, E. (2000). The effects of response rate changes on the index of consumer sentiment. *Public Opinion Quarterly, 64*(4), 413-428.

Danyluk, R., & Holmes, K. (2008). Development and implementation of the Alberta traffic safety plan community mobilization strategy. In *Proceedings of Canadian Multidisciplinary Road Safety Conference XVIII*, June 8-11. Whistler, BC: Canadian Association of Road Safety Professionals.

Dellinger, A. M., Bolen, J., & Sacks, J. J. (1999). A comparison of driver- and passenger-based estimates of alcohol-impaired driving. *American Journal of Preventive Medicine, 16*(4), 283-288.

Desapriya, E., Pike, I., & Babul, S. (2006). Public attitudes, epidemiology and consequences of drinking and driving in British Columbia. *IATSS Research, 30*(1), 101-110.

Ditter, S. M., Elder, R. W., Shults, R. A., Sleet, D. A., Compton, R., & Nichols, J. L. (2005). Effectiveness of designated driver programs for reducing alcohol-impaired driving: A systematic review. *American Journal of Preventative Medicine, 28*(5, supplement 1), 280-287.

Drixler, C., Krahn, H., & Wood, R. T. (2001). Teenage drinking and driving in rural Alberta. *Journal of Youth Studies, 4*(1), 63-81.

Eckardt, M., File, S., Gessa, G., Grant, K., Guerri, C., Hoffman, P. et al. (1998). Effects of moderate alcohol consumption on the central nervous system. *Alcoholism, clinical and experimental research, 22*(5), 998-1040.

Elder, R., Shults, R., Sleet, D., Nichols, J. L., Thompson, R., & Rajab, W. (2004). Effectiveness of mass media campaigns for reducing drinking and driving and alcohol involved crashes. *American Journal of Preventive Medicine, 27*(1), 57-65.

Elder, R. W., Shults, R. A., Sleet, D. A., Nichols, J. L., Zaza, S., & Thompson, R. S. (2002). Effectiveness of sobriety checkpoints for reducing alcohol-involved crashes. *Traffic Injury Prevention, 3*(4), 266-274.

Flowers, N., Naimi, T. S., Brewer, R. D., Elder, R. W., Shults, R. A., & Jiles, R. (2008). Patterns of alcohol consumption and alcohol-impaired driving in the United States. *Alcoholism: Clinical and Experimental Research, 32*(4), 639-644.

Foss, R. D., & Bierness, D. J. (1996). Drinking passengers and their drivers: Roadside survey results. In *Association for the Advancement of Automotive Medicine, 40th Annual Proceedings,* October 7-9, pp. 263-73. Vancouver, BC: AAAM.

Gazso, A., & Krahn, H. (2008). Out of step or leading the parade? Public opinion about income support policy in Alberta, 1995 and 2004. *Journal of Canadian Studies, 42*(1), 154-178.

Groves, R. M. (2006). Non-response rates and non-response bias in household surveys. *Public Opinion Quarterly, 70*(5), 646-675.

Hartling, L., Wiebe, N., Russell, K., Petruk, J., Spinola, C., & Klassen, T. P. (2004). Graduated driver licensing for reducing motor vehicle crashes among young drivers. *The Cochrane Database of Systematic Reviews, 2*. Art. No.: CD003300.pub2. doi: 10.1002/14651858.CD003300.pub2.

Hasin, D., Paykin, A., Endicott, J., Grant, B. F. (1999). The validity of DSM-IV alcohol abuse: Drunk drivers versus all others. *Journal of Studies on Alcohol, 60*(6), 746-755.

Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs, S16*, 12-20.

Holmila, M., & Raitasalo, K. (2005). Gender differences in drinking: Why do they still exist? *Addiction, 100*(12), 1763-1769.

Howard Research. (2005). *Evaluation of the Alberta Administrative Licence Suspension program*. Calgary and Edmonton: Author.

Isaac, N. E., Kennedy, B., & Graham, J. D. (1995). Who's in the car? Passengers as potential interveners in alcohol-involved fatal crashes. *Accident Analysis & Prevention, 27*(2), 159-165.

Keeter, S., Miller, C., Kohut, A., Groves, R. M., & Presser, S. (2000). Consequences of reducing non-response in a national telephone survey. *Public Opinion Quarterly, 64*(2), 125-148.

Lahaut, V. M., Jansen, H. A., van de Mheen, D., Garretsen, H. F., Verdurmen, J. E., & van Dijk, A. (2003). Estimating non-response bias in a survey on alcohol consumption: Comparison of response waves. *Alcohol and Alcoholism, 38*(2), 128-134.

Leadbeater, B. J., Foran, K., & Grove-White, A. (2008). How much can you drink before driving? The influence of riding with impaired adults and peers on the driving behaviors of urban and rural youth. *Addiction, 103*(4), 629-637.

Lyons, A. C., & Willott, S. A. (2008). Alcohol consumption, gender identities and women's changing social positions. *Sex Roles, 59*(9-10), 694-712.

Marelich, W. D., Berger, D. E., & McKenna, R. B. (2000). Gender differences in the control of alcohol-impaired driving in California. *Journal of Studies on Alcohol, 61*(3), 396-401.

Marques, P. R. (2009). The alcohol ignition interlock and other technologies for the prediction and control of impaired drivers. In J. C. Verster, S. R. Pandi-Perumal, J. G. Ramaekers, & J. J. de Gier, (Eds.), *Drugs, driving and traffic safety* (pp. 457-476). Basel, Switzerland: Birkhauser Verlag.

Mayhew, D. R., Simpson, H. M., & Singhal, D. (2005). *Best practices for graduated driver licensing in Canada*. Ottawa, ON: Traffic Injury Research Foundation.

McCartt, A. T., Mayhew, D. R., Braitman, K. A., Ferguson, S. A., & Simpson, H. M. (2009). Effects of age and experience on young driver crashes: Review of recent literature. *Traffic Injury Prevention, 10*(3), 209-219.

McNeil, P., & Webster, I. (1997). *Canada's alcohol and other drugs survey 1994: A discussion of the findings*. Ottawa: Minister of Public Works and Government Services Canada.

Merkle, D., & Edelman, M. (2002). Non-response in exit polls: A comprehensive analysis. In R. M. Groves, D. A. Dillman, J. L. Eltinge, & R. J. A. Little (Eds.), *Survey non-response* (pp. 243-258). New York: Wiley.

Nurullah, A. S. (2010a). Social influence in impaired driving: An exploration in Alberta, Canada. *International Journal of Interdisciplinary Social Sciences, 5*(3), 447-464.

Nurullah, A. S. (2010b). *The prevalence of alcohol-impaired driving in Alberta*. M.A. Thesis, Department of Sociology, University of Alberta.

O'malley, P., & Johnston, L. (1999). Drinking and driving among US high school seniors, 1984-1997. *American Journal of Public Health, 89*(5), 678-684.

Peck, R. C., Gebers, M. A., Voas, R. B., & Romano, E. (2008). The relationship between blood alcohol concentration (BAC), age, and crash risk. *Journal of Safety Research, 39*(3), 311-319.

Peng, C. J., Lee, K. L., & Ingersoll, G. M. (2002). An introduction to logistic regression analysis and reporting. *Journal of Educational Research, 96*(1), 3-15.

Poulin, C., Boudreau, B., & Ashbridge, M. (2006). Adolescent passengers of drunk drivers: A multi-level exploration into the inequities of risk and safety. *Addiction, 102*(1), 51-61.

Rehm, J., Room, R., Graham, K., Monteiro, M., Gmel, G., & Sempos, C. (2003). The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: An overview. *Addiction, 98*(9), 1209-1228.

Schwartz, J. (2008). Gender differences in drunk driving prevalence rates and trends: A 20-year assessment using multiple sources of evidence. *Addictive Behaviors, 33*(9), 1217-1222.

Shope, J. T. (2007). Graduated driver licensing: Review of evaluation results since 2002. *Journal of Safety Research, 38*(2), 165-175.

Shults, R. A., Kresnow, M., & Lee, K. C. (2009). Driver- and passenger-based estimates of alcohol-impaired driving in the U.S., 2001-2003. *American Journal of Preventive Medicine, 36*(6), 515-522.

Shults, R. A., Elder, R. W., Sleet, D. A., Nichols, J. L., Alao, M. O., & Carande-Kulis, V. G., et al. (2001). Reviews of evidence regarding interventions to reduce alcohol impaired driving. *American Journal of Preventive Medicine, 21* (4, supplement 1), 66-88.

Simpson, H. M., Mayhew, D. R., & Beirness, D. J. (1992). *National survey on drinking and driving 1988: Technical report*. Ottawa: Health and Welfare Canada and Transport Canada.

Soderstrom, C. A., Dischinger, P. C., & Kerns, T. J. (1996). Alcohol use among injured sets of drivers and passengers. *Accident Analysis & Prevention, 28*(1), 111-114.

Solomon, R., & Chamberlain, E. (2010, January 5). MADD report suggests that Alberta's traffic safety laws need improvement. Retrieved on March 29, 2010, from http://www.madd.ca/english/news/stories/n20100105.htm

Stockwell, T., Sturge, J., & Jones, W. (2006). *Cannabis use in British Columbia: Patterns of use, perceptions, and public opinion as assessed in the 2004 Canadian Addiction Survey*. Victoria: Centre for Addictions Research of British Columbia.

Tourangeau, R. (2004). Survey research and societal change. *Annual Review of Psychology, 55*, 775-801.

Transport Canada. (2008, November). *A quick look at alcohol-related crashes in Canada* (Report no. TP 2436 E). Ontario: Transport Canada. Retrieved on August 27, 2010, from http://www.tc.gc.ca/roadsafety/tp/tp2436/rs200809/menu.htm

Vanlaar, W., Robertson, R., Marcoux, K., Mayhew, D., Brown, S., & Boase, P. (2012). Trends in alcohol-impaired driving in Canada. *Accident Analysis & Prevention, 48*, 297-302.

Vanlaar, W., Marcoux, K., & Robertson, R. (2009). *The road safety monitor 2009: Drinking and driving in Canada*. Ottawa: Traffic Injury Research Foundation.

Wallace, M. (2009). Police-reported crime statistics in Canada, 2008. *Juristat, 29*(3), Catalogue no. 85-002-X. Ottawa: Canadian Centre for Justice Statistics, Statistics Canada.

Wechsler, H., Lee, J. E., Nelson, T. F., & Lee, H. (2003). Drinking and driving among college students: The influence of alcohol-control policies. *American Journal of Preventive Medicine, 25*(3), 212-218.

Wilson, R. J. (1984). *A national household survey on drinking and driving*. Ottawa: Road Safety and Motor Vehicle Directorate, Transport Canada.